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Avoid Breaker Panel Upgrades with Solar and Storage for Self-Consumption

Additional submitted attachment is included below.

CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

Electric Program Investment Charge 2026–2030 (EPIC 5) Research Concept Proposal Form

1. Please provide the name, email, and phone number of the best person to contact

Meghan Wood
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2. Please provide the name of the contact person's organization or affiliation:

Raya Power Inc. (rayapower.com)

3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

Rapid-Deploy, Small-Capacity, Non-Export Solar + Storage for Self-Consumption, Grid Relief, and Resilience — Focused on LMI, Renters, ADUs, Manufactured Homes, and Tribal Nations

This research will evaluate how small-scale (1- 3 kW) non-export, behind-the-meter solar and battery storage systems—not interconnected to the grid, not backfeeding the home wiring, and optimized for self-consumption—can increase a home's effective breaker capacity without costly breaker panel or service upgrades. By using intelligent load management, these systems will offset new electrical loads with on-site solar generation and storage, enabling the installation of other electrification measures such as heat pumps, induction cooking, or EV charging without overloading the home's electrical panel.

Designed for low- to moderate-income households, renters, ADUs, manufactured homes, and tribal nations, the systems will be quick-install and non-invasive, avoiding structural modifications. EPIC funding is essential to validate technical performance, assess cost-effectiveness, and produce a scalable deployment model that supports California's clean energy, equity, and climate resilience goals, while gathering enough data points across system tests to prove that this solution can reliably increase effective breaker capacity and enable electrification upgrades without panel or service changes.

4. In accordance with Senate Bill 96[1], please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals."

This concept delivers a breakthrough pathway for expanding electrification and distributed energy resources (DERs) into segments of California's housing market that have historically been left behind due to cost, permitting delays, and infrastructure constraints.
Key advancements include:

- **Non-Export, Non-Interconnected Design** – Avoids lengthy interconnection queues, utility approval bottlenecks, and complex permitting requirements, enabling rapid deployment. No backfeed to the home's existing wiring, meaning it is code-compliant today.

- **Virtual Breaker Capacity Increase** – By integrating intelligent storage dispatch and load management, the system can offset demand from high-load appliances through the use of on-site solar generation, effectively increasing usable breaker capacity without physical panel upgrades.

- **Enabling Electrification Without Upgrades** – Creates a pathway for installing heat pumps, induction cooking, EV chargers, and other clean technologies without costly electrical infrastructure changes, while providing savings on the increased electricity given the on-site solar generation.

- **Accessibility for Diverse Housing Types** – A true "drop-in" model suitable for renters, manufactured homes, ADUs, and tribal housing—segments often excluded from clean energy programs.

- **Grid-Friendly Operation** – By maximizing self-consumption and avoiding export, the system reduces strain on the distribution network and supports local reliability goals.

- **Affordable and Removable** – Today's solar + storage packages often exceed **$25,000**, pricing out many households. This solution targets a much lower entry price point and can be removed if needed without home modifications, allowing households to move the system to a new

[1] See section (a) (1) of Public Resources Code 25711.5 at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25711.5.

home—ideal for renters, temporary home situations, and disaster relief as well.

Data & Information Gaps Addressed:

- Quantifies the actual breaker capacity increase achieved by self-consumed solar + storage pairing.
- Measures cost savings compared to traditional panel/service upgrades.
- Provides performance data across a diverse set of housing types to inform statewide program design.
- Creates a validated deployment blueprint that utilities, policymakers, and contractors can adopt to scale DER deployment in challenging contexts.

Targets:

- **Installation Time:** <5 hours
- **System Size:** 1-3 kW PV + <=10 kWh storage.
- **Breaker Capacity Increase:** ≥20% without service upgrade.
- **Deployment Cost:** Affordable for LMI households and financing options available.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety,[2] reliability,[3] affordability,[4] environmental sustainability,[5] and equity?[6]

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[2] EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

[3] EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

[4] EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

[5] EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

[6] EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

If successful, this research will:

- **Lower the total cost of electrification** by avoiding panel/service upgrades, allowing households to bundle solar + storage with other clean technologies (heat pumps, induction cooking, EV chargers) without infrastructure changes. Also avoid expensive traditional rooftop solar and storage costs necessary for offerings on the market today.
- **Enable return on investment** for these electrification upgrades by using the solar + storage system to generate bill savings that offset operating costs of the new appliances.
- **Expand equitable access** to clean energy solutions for underserved markets (LMI, renters, ADUs, manufactured homes, tribal nations), directly supporting disadvantaged vulnerable communities.
- **Improve the safety and reliability** of household energy systems by providing a backup supply for critical loads during outages caused by wildfires, PSPS events, or other climate-driven disruptions.
- **Reduce greenhouse gas and pollutant emissions** by replacing fossil-fuel-powered appliances with clean, electric alternatives powered by a truly drop-in on-site solar and storage solution.
- **Reduce strain on the electric grid** by shifting loads to on-site generation during peak demand, while eliminating daytime backfeed.
- **Enhance resilience** by providing 24+ hours of backup for essential loads (e.g., refrigerators, fans, Wi-Fi, lighting) with a self-recharging (from the sun), non-export solar + storage system.

At scale, this approach could:

- **Accelerate statewide electrification** by making bundled clean energy upgrades feasible in constrained electrical environments.
- **Delay or avoid costly grid infrastructure upgrades**, freeing resources for other decarbonization priorities.
- **Deliver a data-driven blueprint** for rapid, equitable DER deployment in diverse housing contexts.
- **Improve environmental sustainability** by lowering land and water use impacts associated with centralized generation and infrastructure expansion.
- **Provide meaningful economic benefits** to ratepayers by combining energy cost savings with avoided infrastructure costs, improving adoption rates across California.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

To evaluate impacts, the project will collect both **quantitative and qualitative data** across all demonstration sites:

- **Installation time** (target: <5 hours) and labor cost per system.
- **Percentage of avoided panel/service upgrades**.
- **Measured increase in available breaker capacity** for additional electrification loads.
- **Peak load offset** achieved by on-site solar + storage.
- **Performance of paired technologies** (e.g., heat pumps powered without panel upgrade).
- Reduction in electricity bills for target homes
- Hours of resilience for critical appliances delivered in an outage
- **Customer satisfaction and adoption rates** in LMI/renter markets, collected through post-install surveys.

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

Happy to share if required with the CEC. Right now this is internal documentation.

8. Describe how this concept supports The EPIC 5 Investment Plan five Strategic Goal

This concept supports multiple EPIC 5 Strategic Goals:

a. Transportation Electrification

- Enable EV charging at home without panel upgrades by using solar + storage to offset charging loads.
- Provide bill savings by powering charging from self-produced solar rather than grid electricity.
- Expands EV adoption potential to renters, LMI households, and other customers traditionally excluded due to infrastructure limitations.

b. Distributed Energy Resource Integration

- Demonstrates a grid-friendly DER model that avoids export and interconnection, minimizing permitting timelines and grid impact.
- Supports aggregation potential for community-level resilience hubs and virtual power plant participation.

c. Building Decarbonization

- Makes electrification upgrades like heat pumps and induction cooking possible without costly electrical infrastructure work.

- Provides a repeatable, scalable model for deploying DER + electrification in constrained housing.

d. Achieving 100% Net-Zero Carbon Emissions & Coordinated Role of Gas

- Broadens clean energy participation to hard-to-reach market segments that are essential for statewide decarbonization.
- Reduces reliance on gas appliances by enabling electric alternatives in homes with limited panel capacity.

e. Climate Adaptation

- Enhances resilience for vulnerable households by providing 24+ hours of backup for critical loads using a self-recharging, non-export solar + storage system.
- Offers disaster-ready, removable “drop-in” deployment potential for use in PSPS events, wildfires, or other climate-driven outages.